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SUCCESS AND PRODUCTIVITY OF KEY RAPTOR SPECIES NESTING IN THE KEVIN RIM RAPTOR STUDY AREA, 2002 -2003

Challenge Cost Share Progress Report to:
Bureau of Land Management
Great Falls District

Al Harmata and Rose Jaffe
Department of Ecology
Fish & Wildlife Program
Montana State University
Bozeman 59717

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ABSTRACT

Nesting success and productivity of Ferruginous Hawks (*Buteo regalis*), Prairie Falcons (*Falco mexicanus*), and Golden Eagles (*Aquila chrysaetos*) in the Kevin Rim Raptor Study Area (KRRSA) of northern Toole County, Montana were determined between 26 - 28 June 2002 and 28 - 30 June 2003. Severe weather occurred throughout KRRSA in late May and mid June 2002. As a result, only 1 Ferruginous Hawk and 2 Prairie Falcon breeding areas were successful in 2002, producing ≥1 and ≥5 nestlings respectively. In 2003, 13 Ferruginous Hawk breeding areas produced ≥36 young; ≥9 Prairie Falcon breeding areas produced ≥24 young, and one Golden Eagle breeding area produced 2 young. Another Golden Eagle breeding area was active but production was not confirmed. Number of successful Ferruginous Hawk nests in the Primary Study Area (PSA) declined from 1988 to 2003 ($P = 0.017$). Ferruginous Hawk banding in 2003 was limited to the Flats ($n = 3$) and a man-made platform in the PSA; 16 nestlings were banded with U.S. Geological Survey (USGS) lock-on bands. No headlight surveys for lagomorphs were conducted in 2002 and 2003 but prey appeared virtually absent in 2002. White-tailed jackrabbits (*Lepus townsendii*) were more commonly observed in KRRSA in 2003 than in recent years. Richardson's ground squirrels (*Spermophilus richardsonii*) were virtually absent in 2002 and appeared less abundant in 2003 than 2001. Any attempt to promote Kevin Rim public lands as a destination for any type of spring-summer recreational activity should be discouraged.

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INTRODUCTION

The Kevin Rim escarpment in northern Toole County, Montana, provides nesting habitat for a variety of raptors (Dubois 1988). The Bureau of Land Management (BLM) designated the Kevin Rim a "Key Raptor Area" and an "Area of Critical Environmental Concern" (Williams and Campbell 1988) to provide added habitat protection for raptors, especially sensitive and declining species. Ferruginous Hawks (*Buteo regalis*), Prairie Falcons (*Falco mexicanus*), and Golden Eagles (*Aquila chrysaetos*) are designated "Species of Special Concern" in Montana (Flath 1991) and are considered *key* species for investigation of aspects of population dynamics in KRRSA. Montana Natural Heritage Program (1999) also lists the Ferruginous Hawk as a Species of Special Concern and the U.S. Fish & Wildlife Service (USFWS) now considers it a species of Conservation Concern (USFWS 2003).

Initial monitoring and nestling raptor banding efforts in the vicinity of the Kevin Rim escarpment began in 1988. Since then, several intensive studies have focused aspects of raptor ecology (Dubois 1988, Harmata 1991, VanHorn 1993, Zelenak 1996, Harmata and Zelenak 1996, Zelenak et al. 1997). Number of successful Ferruginous Hawk nests in KRRSA declined between 1988 and 1997 (Harmata et al. 1999). Banding in portions of KRRSA was suspended in 1999 and number of annual surveys reduced in 2000 due to suspected negative impacts on Ferruginous Hawk productivity. Coincidently, more effort was directed at banding in Ferruginous Hawk nests where banding had not previously occurred. Colorbanding Prairie Falcon and Ferruginous Hawk nestlings began in 1995. However, due to the lack of subsequent observations of colorbands, colorbanding was suspended in 2000.

Changes in Ferruginous Hawk banding protocols provided insight on the effects of banding on Ferruginous Hawk reproduction. Brood sizes of pairs nesting in sites secure from ground predators (platforms, oil tanks, trees) or protected from inclement weather (*i.e.*, vegetative canopy) were larger than those in cliff nests. The propensity to reoccupy nest sites the year after banding suggests nesting adult hawks may be more tolerant of banding activity at more protected sites. Sites along the Rim that produced smaller broods were either accessible to coyotes (*Canis latrans*), foxes (*Vulpes* spp.), and raccoons (*Protocyon lotor*) and/or susceptible to inclement weather by aspect or lack of canopy cover.

2002 -2003 Objectives

A. Determine location, success[1], and productivity[2] of Ferruginous Hawks, Prairie Falcons, Golden Eagles nesting in KRRSA.

B. Band Ferruginous Hawk nestlings with USGS bands in the Flats only.

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[1]Successful pairs (or nests) are those that fledged young.

[2]Productivity is number of young fledged from successful nests.

STUDY AREA

KRRSA is located approximately 32½ km north to northwest of the town of Shelby, Toole County, Montana (Fig. 1). The northeast corner includes the town of Sunburst, Montana. KRRSA includes a Primary Study Area (PSA) that has been surveyed annually since 1988, Rattlesnake Coulee, and immediately adjacent table lands (Flats) to the east and south of PSA (Fig. 1). Prior to 1997, coverage of the Flats was cursory but increased in 1997 through 2001. In 1999, the Flats was divided into NE and SE sections (Fig. 1). Rattlesnake Coulee was surveyed intermittently between 1988 and 1999 depending on time and funds, but not in all years. Buckley Coulee (north of Rattlesnake Coulee outside of KRRSA) was last surveyed in 2000.

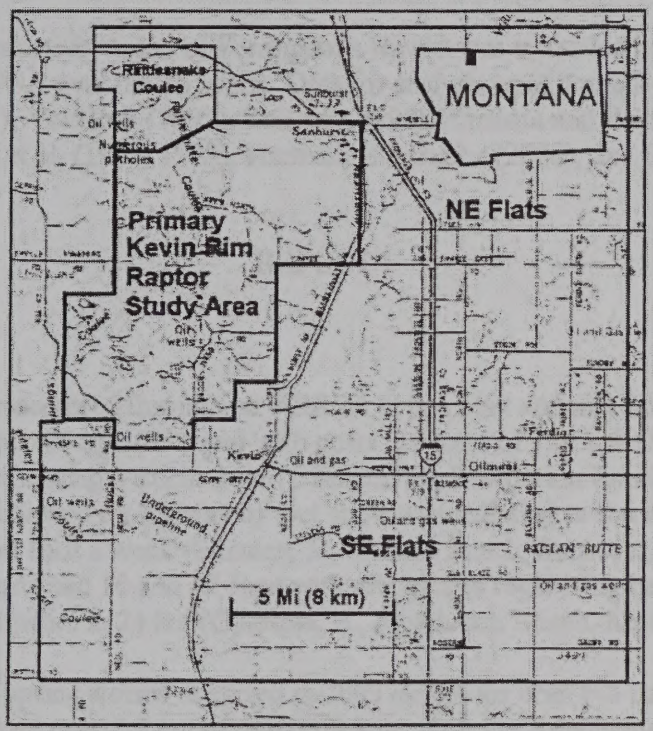


Figure 1. Kevin Rim Raptor Study Area, northern Toole Co., Montana.

METHODS

One survey was conducted in both 2002 and 2003. Surveys of success and productivity were conducted on 26, 27, and 28, June 2002 and 28, 29, and 30 June 2003. All previously identified nest sites were checked and historical breeding areas searches for new nests. Information gathered included location and number of young of advanced age in successful nests, and plumage of adults and progeny of Ferruginous Hawks.

To minimize effects of observer activity on raptor nest success, neither occupancy nor activity surveys (normally conducted in April) were conducted in 2002 and 2003, nor did observers approach Ferruginous Hawk nests closer than 1 km to determine presence of nestlings, unless contained in the sample to be banded. Golden eagle and prairie falcon nestlings of advanced age (>2/3 growth) were considered to have fledged, *i.e.*, nests successful. All Ferruginous Hawk nests containing nestlings, regardless of age were considered successful.

Long-term productivity trend of Ferruginous Hawks was evaluated by regressing number of successful nests in PSA over the 16 years. Data for analysis were compiled from (Dubois 1988), Harmata (1991), VanHorn (1993), Zelenak (1996), Harmata and Zelenak (1996), Zelenak et al. (1997), Harmata et al. (1998, 1999), Harmata and Gabler (2000), and Harmata and Jaffee (2001).

RESULTS

2002 - 2003 Weather

Severe weather occurred throughout KRRSA in late May and mid June 2002. On 22 May, sustained winds of 105 kph (65 mph) with gusts in excess of 129 kph (80 mph) occurred throughout KRRSA, preceding a storm front (Gillespie, B., Revolution Ranch, Kevin, MT pers. comm). Winds were followed on 23 May by wet snow accumulating to 0.6 m to 1 m (2 to 3 ***feet!***) which persisted at least a week (Simmes, T., Simmes Ranch, Sunburst, MT, pers. comm.). Heavy rains occurred between 10 and 12 June with rain gauges registering between 3 and 4 ¾ cm (8 to 12 ***inches!***) of moisture in 24 hrs (Gillespie, B., Revolution Ranch, Kevin, MT pers. comm).

No severe, late spring storms occurred in 2003 except for brief (<1 day) rainfall in early June. The storm produced over 2.5 cm of rain (Gillespie, B. & D., Revolution Ranch, pers. comm.).

2002 Nest Success and Productivity

Only 3 key raptor breeding areas were successful in KRRSA in 2002 (Fig. 2). A Prairie Falcon was the only key raptor successful in PSA. One Ferruginous Hawk and one Prairie Falcon were successful in Rattlesnake Coulee. No Ferruginous Hawks were successful or seen in the Flats. Although adults were observed in all Golden Eagle breeding areas, none produced young.

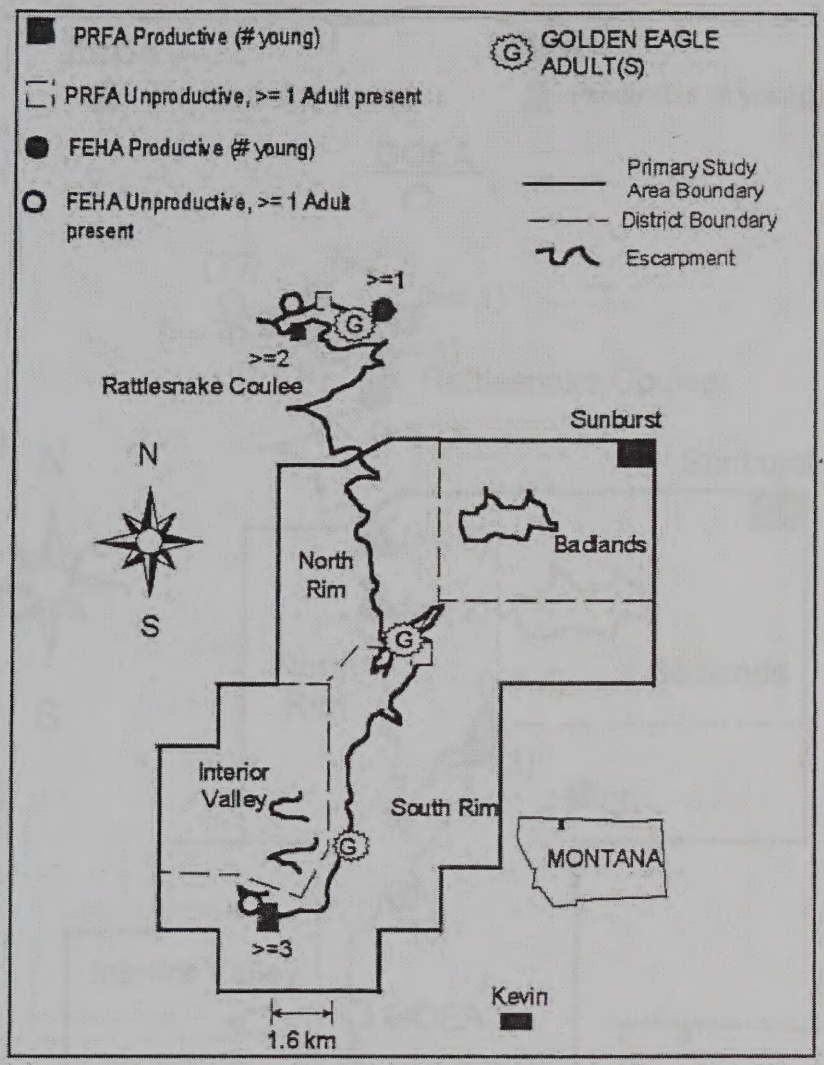


Figure 2. Ferruginous Hawk (FEHA) and Prairie Falcon (PRFA) productivity, Kevin Rim Raptor Study Area, 2002. Golden Eagles occupied breeding areas but did not produce young.

2003 Nest Success and Productivity

Ferruginous Hawks

Thirteen Ferruginous Hawk nests were successful in KRRSA in 2003, 6 in PSA (Fig. 3), 3 in Rattlesnake Coulee (Fig. 3), and 4 in the Flats. Production was ≥36 young (Table 1). A paucity of nesting hawks along the North Rim and southern Rattlesnake Coulee again was evident in 2002 - 2003 (Figs. 2 & 3). Where as many as 7 pairs of hawks nested in prior to 1997, none were present in 2002 and 2003.

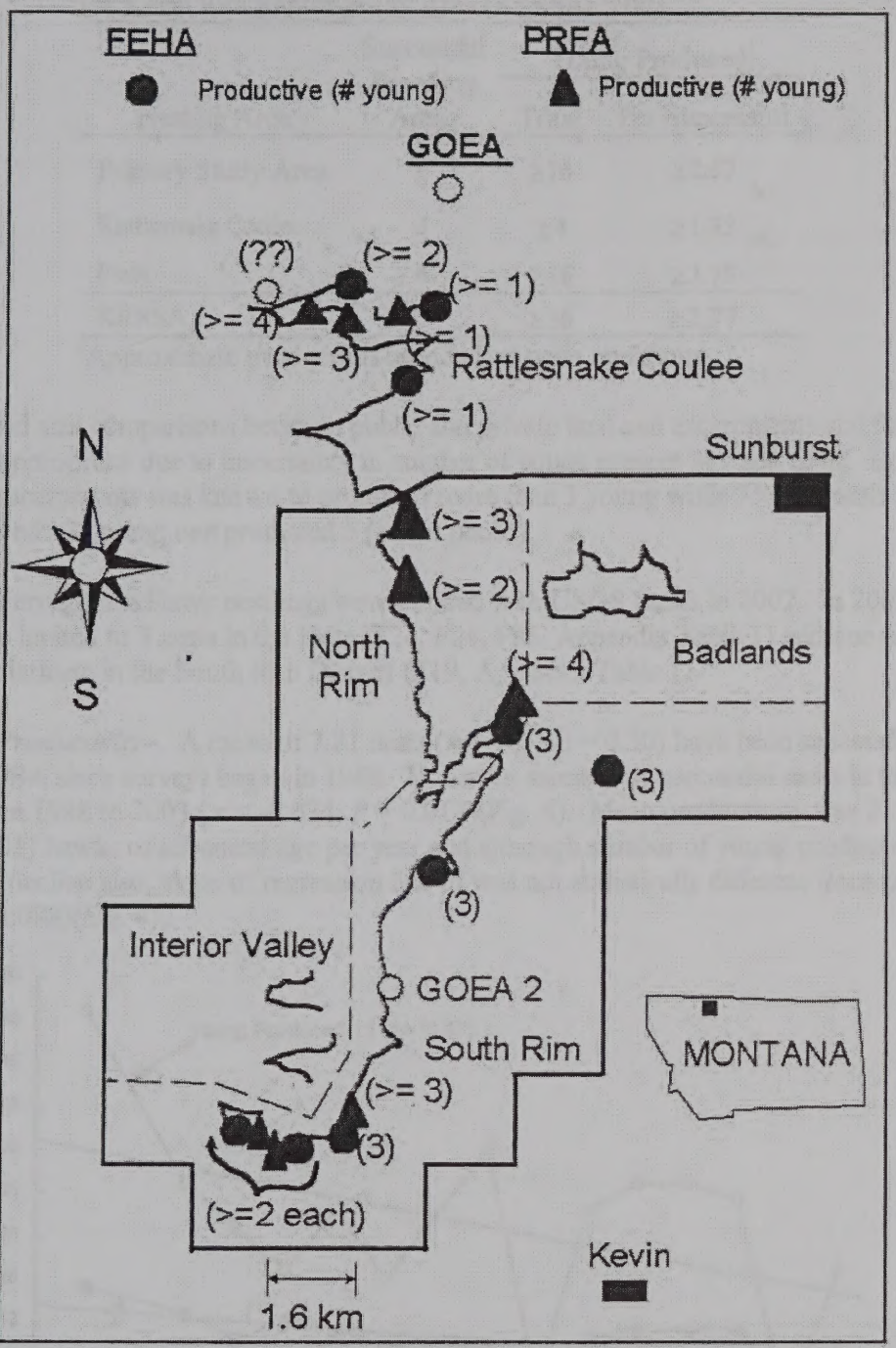


Figure 3. Ferruginous Hawk (FEHA), Prairie Falcons (PRFA), and Golden Eagle (GOEA) productivity on Primary Study Area, and Rattlesnake Coulee, Kevin Rim Raptor Study Area, 2003.

Table 1. Reproductive performance of Ferruginous Hawks in the Kevin Rim Raptor Study Area (KRRSA), 2003.

Nesting Area	Successful Breeding Areas	Young Produced[1]	
		Total	Per Successful
Primary Study Area	6	≥16	≥2.67
Rattlesnake Coulee	3	≥4	≥1.33
Flats	4	≥16	≥3.75
KRRSA	13	≥36	≥2.77

[1]Approximate production-brood sizes were minimum.

Brood size comparisons between public and private land and escarpments and flatlands for 2003 are inappropriate due to uncertainty in number of young present in some nests. However, no nest on escarpments was known to produced more than 3 young while 75% of nests in the Flats produced >3 young; one produced 5 (cover photo).

No Ferruginous Hawk nestlings were banded with USGS bands in 2002. In 2003, banding was limited to 3 nests in the Flats (F21, F24, F26, Appendix Table 1) and one nest on a man-made platform in the South Rim District (F19, Appendix Table 1).

Long-term Productivity–. A mean of 7.81 nests ($n = 14$, SE = 0.30) have been successful per year in the PSA since surveys began in 1988. However, number of successful nests in the PSA declined from 1988 to 2003 ($r = -0.624$, $P = 0.017$)(Fig. 4). Mean productivity was 21.1 ($n = 14$, SE = 3.01) hawks of advanced age per year and although number of young produced per year appeared to decline also, slope of regression line of was not statistically different from zero ($r = -0.472$, $P = 0.088$)(Fig. 4).

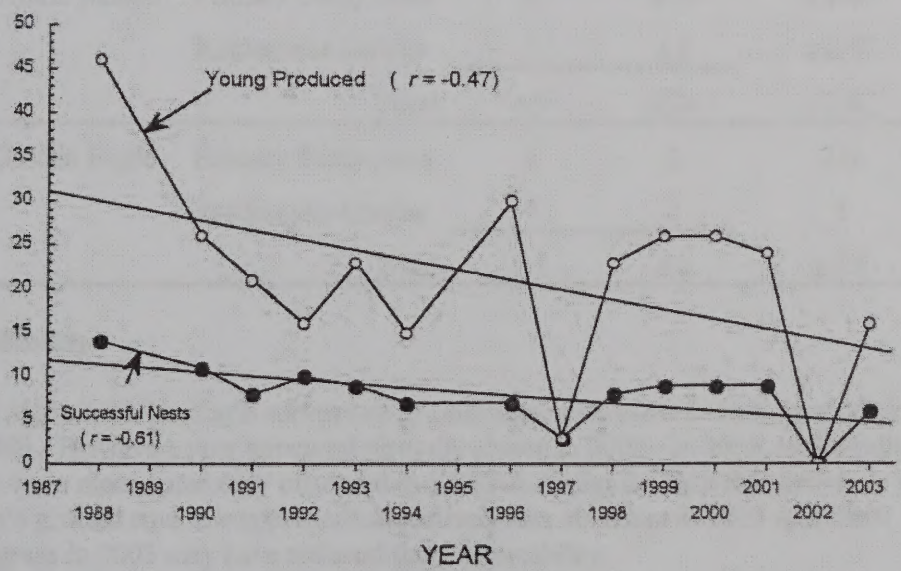
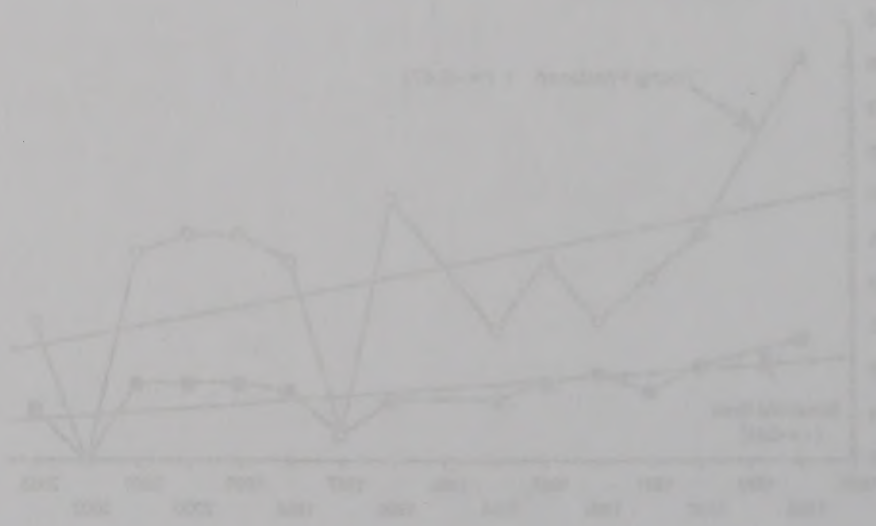


Figure 4. Successful nests and productivity of Ferruginous Hawks in the Primary Study Area, 1988 - 2003.



Prairie Falcons and Golden Eagles

Nine Prairie Falcon pairs were known to have produced ≥24 young in PSA and Rattlesnake Coulee in 2003 (Fig. 3; Table 2, Appendix Table 2). Adult falcons were observed at 2 eyries considered unproductive.

Golden Eagles produced at only one nest in KRRSA (Fig. 3). The pair was approximately 1 km north-northeast of the last known productive nest in the PSA and contained 2 nestlings. No Golden Eagles were observed at the other breeding area in PSA (G2, Appendix Table 2). An adult Golden Eagle pair was observed in Rattlesnake Coulee at a nest previously occupied by Ferruginous Hawks (F16A, Appendix Table 1). The nest was adorned with greenery and copious amounts of excrement covered the cliff face behind the nest, indicating the nest contained young of advanced age in 2003. None could be seen. A nestling may have been laying low in the nest undetected or may have fledged, although all cliff lines were searched intensively. It is equally likely the nest failed.

No adult eagles were observed at nest G3, a site where at least one adult has been present during surveys for over a decade. We suspect the eagles associated with nest F16A were those usually associated with nest G3.

Table 2. Minimum Prairie Falcon and Golden Eagle productivity in the Kevin Rim Raptor Study Area, 2003.

Species	Nesting Area	Successful Breeding Areas	Young	
			Fledged	per Successful Breeding Area
Prairie Falcon	Primary Study Area	6	≥16	≥2.67
	Rattlesnake Coulee	3	≥8	≥2.67
	Total	≥9	≥24	≥2.67
Golden Eagle	Primary Study Area	1	2	2.0
	Rattlesnake Coulee	?	?	?
	Total	≥1	≥2	≥2.0

Prey Availability

No lagomorph headlight surveys or ground squirrel burrow counts were conducted in 2002 or 2003. However, prey appeared virtually absent in 2002. In 2003, white-tailed jackrabbits were more commonly observed in KRRSA during daylight than previous years. Richardson's ground squirrels appeared subjectively less abundant in 2003 than 2001 but higher, more lush grass in 2003 may have reduced their detectability.

DISCUSSION

A nearly complete and catastrophic nesting failure of hawks, falcons, and eagles occurred throughout KRRSA in 2002. Severe weather was most certainly the culprit. Winds and heavy snow in late May were at a time when young Ferruginous Hawks would have been hatching or newly hatched, assuming an 18 April median egg laying date (Palmer 1988). A 1 m snowfall probably would have completely covered an adult laying in a nest and eventually overwhelmed incubation or brooding behavior. If an adult hawk stood or left the nest to shed snow, eggs or young probably would have been covered. Exposed to the elements, even for a short time, young nestlings would quickly succumb to moisture and low temperatures. Prairie Falcons, although nesting in somewhat more sheltered conditions, apparently did not fair much better than hawks. Perhaps strong winds drove snow into eyries with the same lethal result to eyasses. Golden Eagle young would have been approximately 2½ to 3 weeks old in late May and still primarily downy. Thermoregulatory capacity of nestlings is nearly complete at this time but adult eagles become less attentive to brooding, exposing nestlings to weather. Down loses it's insulative effect when wet and nestling eagles may have been become wet during extended exposure to snow.

Heavy rains in mid June also would have occurred at a sensitive time for raptor nestlings. Young Ferruginous Hawks would have been between 20 and 25 days old and less than 50% feathered (Moritsch 1985). This plumage composition protects against most weather but not moisture. During this period adults do little more than shade nestlings (they're a desert adapted species). Thus, any nestling hawks surviving the earlier snow storm may have succumbed after being soaked in by intense rains. Prairie Falcon eyries may not be immune to flooding from runoff or direct rain, depending on winds and exposure. Golden Eagles would have been more able to survive rain but any produced in 2002 probably perished during the earlier snow storm.

Productivity in 2003 for all key species was markedly better. However, the early June rain may have affected hawk production. As a result of fair precipitation in 2002 and 2003, ground vegetation in KRRSA was more lush over a more extensive area than has occurred in a decade. Verdant vegetation may have further reduced hawk and falcon productivity in 2003 due to difficulty of detection and capture of principal prey (Richardson's ground squirrels and terrestrial birds).

Ferruginous Hawk nestling banding in the Flats continues to provide insight on the effects of banding on Ferruginous Hawk reproduction. Brood sizes of pairs nesting in sites secure from ground predators (platforms, oil tanks, trees) or protected from inclement weather (*i.e.*, vegetative canopy) continue to be large despite annual incursions into the nests for banding. The propensity to reoccupy nest sites the year after banding suggests nesting adult hawks may be more tolerant of banding activity at more protected (or productive) sites. Sites in the PSA that produced smaller broods were either accessible to coyotes (*Canis latrans*) and foxes (*Vulpes* spp.) and/or susceptible to inclement weather by aspect or lack of canopy cover. Perhaps environmental factors are most influential on subsequent nest occupancy and productivity and banding has no effect.

Continued absence of successful hawks and falcons on the North Rim, Badlands, and southern Rattlesnake Coulee is troubling and we are still at loss for an explanation. Depressing factors are either very subtle or exerted at a time raptor observers are absent. More than a decade of declining productivity may be a component of a normal, long-term cyclic pattern or indicative of populations under stress.

MANAGEMENT RECOMMENDATIONS

Management recommendations presented in Harmata and Gabler (2000) are still appropriate, especially the need for an integrated Kevin Rim Raptor Management Plan, directed specifically at reducing human impacts on nesting raptors. Additionally, low success rate of Prairie Falcons and apparent turnover of Golden Eagle adults in at least 3 of the 4 breeding areas in KRRSA in recent years suggests higher than normal mortality, possibly due to anthropogenic effects.

Since removing cautionary signs on the top of the South Rim, disruptive human incursions above falcon, hawk, and eagle nests appear to have diminished (Gillespie, B., pers. comm.). Apparently signs intended to deter public visitation of cliffs above raptor breeding sites had the opposite effect, actually alerting visitors to the area and encouraging inspection. We advocate active discouragement of any attempt to promote Kevin Rim public lands as a destination for any type of spring-summer recreational activity (*i.e.*, birding, off-road vehicle, hiking).

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